REMARKS

Claims 1-10 are the claims pending in the application. Applicants have added new claim 10 to more particularly define the invention. Applicants respectfully traverse the prior art rejection based on the following discussion.

I. The 35 U.S.C. Section 112, First Paragraph Rejection

In response to the 35 U.S.C. Section 112, First Paragraph Rejection, Applicant has amended claim 1 to indicate that the hardware element configuration is a predetermined configuration upon production consistent with the Examiner's helpful comments as indicated above.

In view of the foregoing, Applicant respectfully requests that the Examiner withdraw the rejection.

II. Prior Art Rejections

Claims 1-9 are rejected under 35 U.S.C. Section 102(b) as being anticipated by Shimada, et al. ("Shimada")(U.S. Patent No. 4,110,394). Claims 1-9 are rejected under 35 U.S.C. Section 102(b) as being anticipated by Muller, et al. ("Muller")(U.S. Patent No. 4,608,210). Claims 1-9 are rejected under 35 U.S.C. Section 102(b) as being anticipated by Piovoso, et al. ("Piovoso")(PCT WO 00/20190).

A. The Rejection Based on Shimada

Regarding claims 1-9, Shimada fails to disclose, teach or suggest the features of independent claim 1, including employing multiple feed streams of raw ingredients at

feed rates for compounding into a composite material. (See Application, Page 10, line 4-Page 11, line 12; Page 12, line 22-Page 13, line 8; Page 14, lines 4-18; Page 15, lines 3-16; and Figures 1 and 2).

Indeed, Figures 1-5 of Shimada merely teach a conventional process for extrusion forming of a resin formed body with a uniform composition but having several wall thicknesses, that is, varying the geometry. This process may be implemented without increasing or decreasing a take-up speed of the formed body, which traditionally results in wrinkles or cracks in the formed body. In particular, the process includes feeding a raw resin material from a hopper 1 into an extruder 3 by a material feeding means 2 where the raw resin material is mixed and melted in the extruder 3. Afterwards, the raw resin material, which is mixed and melted, is pushed out in a tubular form through a die 4 passing through an outer diameter readjusting means 5 where it is cooled and taken-up by a take-up machine 7. More particularly, a single input stream of the raw resin material with a specific input composition is feed into the extruder 3 where the resin formed body has an output composition, which is the same composition as the input composition. However, the wall thicknesses of the resin formed body are varied, that is, at least one geometric change is produced by this process without changing the composition or producing a compositional gradient like Applicant's invention. This geometric change in wall thicknesses are generated by input disturbances, that is, during this process, a step change in the extruder 3 screw speed may be introduced (what the Office Action attempts to analogize to Applicant's operating conditions) resulting in a change in the feed quantity of material from the material feeding means 2 (what the Office Action attempts to analogize to Applicant's material rate input change). Consequently, the quantity of the

resin formed body out of the die 4 may be increased without changing substantially the material filling rate of the extruder. Importantly, the process uses a single input stream of the raw resin material with a specific composition, which is not brought together with other feed streams of raw ingredients for compounding into a composite material like Applicant's claimed invention. As indicated above, the input composition is the same as the output composition, without reference to using at least a second feed stream like Applicant's claimed invention. Accordingly, Shimada's structure is consistent with the function of the invention as the geometry of the resin formed body includes varying wall thicknesses but the composition of the resin formed body is the same as the composition of the raw resin material. Thus, Shimada only teaches or suggest a single input stream of a raw resin material without a second feed stream of a different material unlike the multiple-feed streams of different materials being compounded into a composite material like Applicant's invention. Please note, the Office Action also does not expressly or implicitly provide for such a recitation of more than one feed stream in the Shimada reference. (See Office Action, Page 2-Page 3, Section 5; Shimada at Abstract; Column 1, lines 5-40; Column 2, lines 5-59; Column 4, lines 7-25; and Figures 1-5).

In contrast, Applicant discloses a process for making a gradient material where multiple feed streams of different materials are compounded and fed through a twin screw extruder for producing a final material where the final material includes at least a segment having a compositional gradient. The process includes an extruder system including an extruder 100 with two screws 102 running through temperature controlled modular barrels 10 where feeders 106 attached to barrels 104 control the addition, that is, feed rates of liquid or solid ingredients, such as, raw ingredients, into the process for

compounding to produce a composite material in the twin screw extruder 100. During the process, a user may vary the material rate input conditions and operating conditions in order to introduce disturbances into at least one of the feed streams of a feeder 106 as well as define a given hardware element configuration. Consequently, the final material extruded through a die 108 includes at least a segment having a compositional gradient in an architecture of the composite material, which was produced as a result of compounding. Accordingly, the final material is a gradient material formed by the screw extruder 100, and related system .

Importantly, the process includes multiple feed streams of raw ingredients at feed rates for compounding into a composite material where the composite material is an intermediate material, for example, as recited in new claim 10. By using multiple feed streams of different raw ingredients, a final gradient propellant material with different characteristics can ultimately be formed to enhance performance of the propellant. Thus, Applicant's process requires the use of multiple feed streams of raw ingredients unlike Shimada's process including, in part, one feed stream, which is not brought together with new ingredients. (See Application, above).

Finally, and for emphasis, Applicant discloses that the process includes employing multiple feed streams of raw ingredients at feed rates for compounding into a composite material and producing a resultant final propellant material with at least one segment having a compositional gradient. In contrast, Shimada only discloses a process for extrusion of a resin using a single input stream of a single material, let alone, forming, in an exemplary embodiment, a propellant material, let alone, using multiple feed streams of different raw ingredients to form a final material with a compositional gradient section.

An attempt to substitute Shimada's process including a single input stream of resin material would <u>not</u> be a compatible process with Applicant's process, which includes employing multiple feed streams of raw ingredients at feed rates for compounding and applying disturbances to at least one of the feed streams, and thus an attempted substitution would likely <u>fail.</u> To be sure, the conventional Shimada technology using a single material pushed through an extruder would only produce a final material with a variety of wall thicknesses, that is, geometric changes, and would <u>not</u> produce a final material with a section with a compositional ingredient particularly as only one material is used in Shimada so a gradient of different materials cannot be established.

Therefore, Applicant's invention is a <u>distinct</u> structure compared to the conventional Shimada invention. Thus, and using the most recent and more relaxed interpretation of obviousness under <u>KSR v. Teleflex</u>, No. 04-1350, 550 U.S. __ (April 30, 2007), Shimada does not disclose, teach or suggest the features of independent claim 1, including <u>employing multiple feed streams of raw ingredients at feed rates for compounding into a composite material</u>. (See above).

Based on the above, the Applicant traverses the assertion that Shimada discloses or teaches Applicant's invention of independent claim 1, and related dependent claims 2-9.

<u>B. The Rejection Based on Muller</u>

Regarding claims 1-9, Muller fails to disclose, teach or suggest the features of independent claim 1, including <u>producing a final material including at least a segment having a compositional gradient in an architecture of the composite material where the</u>

final material is a gradient material formed by the screw extruder system. (See Application, Page 3, line 22-Page 4, line 5; Page 5, line 16-Page 6, line 3; Page 7, lines 4-6; Page 9, lines 13-15; Page 10, line 4-Page 11, line 12; Page 12, line 20-Page 13, line 8; Page 14, lines 4-18; Page 15, lines 3-16; and Figures 1 and 2).

Indeed, Figures 1-4 of Muller merely teach a conventional method for producing plastically bonded propulsion powders and explosives with a simultaneous reduction of the plastic binder component where the final mixture ratio of the explosive/propulsive powder and plastic binder are held constant so that the final product has a uniform composition without compositional gradients. In particular, the process includes adding plastic binder from a storage container 11 through an inlet opening 9 while the screw shafts 5 reciprocate. Afterwards, a feed device 14 is operated to conduct the crystalline explosive material from the storage container 12 through the channel 10 into the inlet opening 9 where the revolutions of the feeding device 12 are steadily increased. Simultaneously, the revolutions of a feeding device 13 are decreased in order to produce the desired mixture ratio. More particularly, this process provides disturbances with a series of steps in one direction, that is, is a one way process with steadily increasing solids input, until the mixture ratio is held constant. Contrary to the assertion in the Office Action, the final material is a uniform composition without a gradient as the final uniform composition occurs when the mixture ratio of the explosive powder to plastic binder is held constant. Importantly, the steadily increasing ratio produces "scrap" intermediate material where the gradient is constantly changing until the final ratio is determined. Consequently, the resultant material is produced with a constant, uniform composition throughout the resultant material unlike Applicant's claimed invention,

which includes a final material with at least a segment composed of a compositional gradient, that is, a non-uniform compositional gradient. Please note, the "gradient material" as suggested in the Office Action is more structurally equivalent to the "scrap" intermediate material not the final resultant material. Accordingly, Muller's process and related structure of the invention is consistent with the function of the invention as the final resultant explosive material is a material with a uniform composition without a gradient. Thus, Muller only teaches or suggest a final material with a uniform composition based on a specific mixture ratio without any gradient or gradient section like Applicant's invention. Please note, the Office Action provides for a changing gradient in the composition until the final mixture ratio is determined without expressly or implicitly providing for such a recitation of a final gradient in the final composition in the Muller reference. (See Office Action, Page 3, Section 7; Muller at Abstract; Column 1, lines 5-40; Column 3, line 17- Column 4, line 42; and Figures 1-4).

In contrast, as discussed above, Applicant discloses a process for making a gradient material where multiple feed streams of different materials are compounded and fed through a twin screw extruder for producing a final material where the final material includes at least a segment having a compositional gradient. Based on this process, and for emphasis, the final material extruded through a die 108 includes at least a segment having a compositional gradient in an architecture of the composite material, which was produced as a result of compounding. Accordingly, the final material is a gradient material as it includes at least a segment with a non-uniform compositional gradient formed by the screw extruder 100, and related system.

Importantly, the process includes multiple feed streams of raw ingredients at feed rates for compounding into a composite material where the composite material is an intermediate material, for example, as recited in new claim 10. By using multiple feed streams of different raw ingredients, a gradient propellant material with different characteristics can ultimately be formed to enhance performance of the propellant. In contrast, Muller's process suggests that the feed streams and the resultant ingredients are set once the desired mixing ratio is obtained. (See Application, above).

Finally, and for emphasis, Applicant discloses that the process includes employing multiple feed streams of raw ingredients at feed rates for compounding into a composite material and producing a resultant final propellant material with at least one segment having a compositional gradient in an architecture of the composite material where the final material is a gradient material formed by the screw extruder system. In contrast, Muller only discloses a process for producing propulsion powders and explosives with a uniform composition at the final mixture ratio, let alone, the final material including a compositional gradient section. An attempt to substitute Muller's process, which includes constantly increasing solids input until reaching the desired final mixture ratio, would not be a compatible process with Applicant's process. Indeed, Applicant's process includes employing multiple feed streams of raw ingredients at feed rates for compounding and applying disturbances to at least one of the feed streams without any final mixture ratio, and thus an attempted substitution would likely fail. To be sure, the conventional Muller technology produces a final material with a uniform composition but without any compositional gradient, and would not produce a final material with at least one section with a compositional ingredient, that is, a non-uniform

compositional gradient, particularly as a gradient of different materials cannot be established at a constant mixture ratio.

Therefore, Applicant's invention is a distinct structure compared to the conventional Muller invention. Thus, and using the most recent and more relaxed interpretation of obviousness under KSR v. Teleflex, No. 04-1350, 550 U.S. __ (April 30, 2007), Muller does not disclose, teach or suggest the features of independent claim 1, including producing a final material including at least a segment having a compositional gradient in an architecture of the composite material where the final material is a gradient material formed by the screw extruder system. (See above).

Based on the above, the Applicant traverses the assertion that Muller discloses or teaches Applicant's invention of independent claim 1, and related dependent claims 2-9.

C. The Rejection Based on Piovoso

Regarding claims 1-9, Piovoso fails to disclose, teach or suggest the features of independent claim 1, including introducing disturbances into at least one of the feed streams by altering at least one of the material rate input conditions and the operating conditions, in conjunction with a predetermined hardware element configuration of the hardware element configurations. (See Application, Page 3, line 22-Page 4, line 5; Page 5, line 16-Page 6, line 3; Page 7, lines 4-6; Page 9, lines 13-15; Page 10, line 4-Page 11, line 12; Page 12, line 20-Page 13, line 8; Page 14, lines 4-18; Page 15, lines 3-16; and Figures 1 and 2).

Indeed, Figures 1 and 2 of Piovoso merely teach a method for control of an extrusion process by applying dynamic periodic pulses to the process and analyzing feedback results to adjust process parameters and production properties. More

particularly, this process discloses or suggests a pulsing test system for control decisions in order to adjust process parameters and anticipate drift during production not define a process for producing a final material, let alone, with a compositional gradient, like Applicant's invention. In particular, the Piovoso process includes adding, on a regular, repeated basis, a pulse mass of pre-weighted material 1 to an extrusion process running at normal, steady state operating conditions. The material is added to perturb the steady-state operation via a mass or chemical disturbance as the pulse mass 1 is added at a point where the feeds enter the extruder 3. This periodic pulse technique monitors feed transport, melting, mixing, pumping and chemical reactions of a twin-screw extruder production process where signals generated during production are sent and connected to a data acquisition system signal conditioning front end hardware 7. A pulse analysis and control computer 10 control the pulse test cycle, performs signal processing 12 to analyze the pulse response 11 input from the data acquisition hardware 9, calculates a control decision 13 and outputs the control setpoints 14 to the data acquisition hardware 9 or the extrusion process operator. Importantly, a control algorithm calculates new control setpoints 14 based on the pulse response 11 so that setpoint signals 15 and the human operator may manipulate the process to maintain product quality. Accordingly, this periodic pulse extrusion control process perturbs the process intentionally "each and every time a product property measurement is required." Contrary to the assertion in the Office Action, the control setputs computed from the pulse response model adjust for changes in ingredients and the extrusion process over time scales determined by the pulse test cycle interval not introduce pulse disturbances, for example, into the material input, in the process of forming an actual final material with a compositional gradient like

Applicant's invention. To be sure, Piovoso indicates that the dynamic response of the pulse is more immune to changes that affect traditional sensor measurements, such as melt temperature and pressure, as a suggested basis for this pulse test. Thus, Piovoso only teaches or suggests a pulse test process using periodic pulse disturbances to perturb an extrusion process not introduce non-pulse disturbances to alter at least one of the material rate input conditions and the operating conditions to form a final material with a gradient section like Applicant's invention. (See Office Action, Page 3, Section 9; Piovoso at Abstract; Page 1, lines 4-7 and lines 32-37; Page 2, lines 1-10; Page 2, line 24-Page 4, line 30; Page 5, lines 11-16; Page 6, line 29-Page 7, line 10; Page 8, lines 20-27; and Figures 1 and 2).

In contrast, as discussed above, Applicant discloses a process for making a gradient material where multiple feed streams of different materials are compounded and fed through a twin screw extruder for producing a final material where the final material includes at least a segment having a compositional gradient. Based on this process, and for emphasis, a user introduces non-pulse disturbances into at least one of the feed streams of a feeder 106 in order to alter at least one of the material rate input conditions and operating conditions at a predetermined hardware element configuration in order to form the final material. As indicated, the final material extruded through a die 108 includes at least a segment having a compositional gradient, that is, a non-uniform compositional gradient, in an architecture of the composite material.

Importantly, Applicant submits that single step disturbances, series of step disturbances, continuous linear ramp disturbances or nonlinear ramp disturbances are the desired disturbances associated with material input conditions or operating conditions not

pulse disturbances as disclosed by Piovoso. By using multiple feed streams of different raw ingredients in conjunction with the above types of introduced non-pulse disturbances, a gradient propellant material with different characteristics can ultimately be formed to enhance performance of the propellant. In contrast, Piovoso's feedback pulse test process for instituting control decisions suggests using pulses, and seems to teach away from using other disturbances, such as, the disturbances identified above and used by Applicant during manufacturing. (See Application, above, and Page 11, lines 17-20 with emphasis).

Finally, and for emphasis, Applicant discloses a production process for making a gradient material, including, in pertinent part, introducing non-pulse disturbances into at least one of the feed streams by altering at least one of the material rate input conditions and the operating conditions, in conjunction with a predetermined hardware element configuration in order to produce a final propellant material with at least one segment having a compositional gradient. In contrast, Piovoso only discloses a pulsing test system using pulse impulses for control decisions in order to adjust process parameters and anticipate drift during production not define a process for producing a final material, let alone, introducing non-pulse disturbances into at least one of the feed streams by altering at least one of the material rate input conditions and the operating conditions, let alone, produce a final material with a compositional gradient like Applicant's invention. An attempt to substitute Piovoso's pulse test system including using only pulse impulses for obtaining desired adjustment process parameters to control production would not be a compatible process with Applicant's process, which includes introducing non-pulse disturbances into at least one of the feed streams by altering at least one of the material

rate input conditions and the operating conditions, to produce a final propellant material, and thus an attempted substitution would likely fail. To be sure, the Piovoso technology only uses pulse impulses as part of a feedback control system to anticipate and control drift during manufacturing but does not define a manufacturing process using non-pulse disturbances, and thus the Piovoso technology would not produce a final material with at least one section with a compositional ingredient.

Therefore, Applicant's invention is a distinct structure compared to the conventional Piovoso invention. Thus, and using the most recent and more relaxed interpretation of obviousness under KSR v. Teleflex, No. 04-1350, 550 U.S. __ (April 30, 2007), Piovoso does not disclose, teach or suggest the features of independent claim 1, including introducing disturbances into at least one of the feed streams by altering at least one of the material rate input conditions and the operating conditions, in conjunction with a predetermined hardware element configuration of the hardware element configurations.. (See above).

Based on the above, the Applicant traverses the assertion that Piovoso discloses or teaches Applicant's invention of independent claim 1, and related dependent claims 2-9.

III. Formal Matters and Conclusions

In view of the foregoing, Applicants submit that claim 1-10, all the claims presently pending in the application, is patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary.

Please charge any deficiencies and credit any overpayment to Attorney's Deposit Account Number 50-1114.

Respectfully submitted,

Dated: 17 March 2008

Fredric J. Zimmerman
Registration No. 48, 747

Department of the Navy
Office of Counsel
3824 Strauss Ave., Suite 103
Indian Head, MD 20640-5152